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Full Length Research

THE IMPACT OF HEALTH ON ECONOMIC GROWTH IN NIGERIA

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This paper attempts to examine the impact of health on economic growth. The rate of growth is measured using per capita income and health status is measured using life expectancy rate. The above impacts are measured using a multivariate framework controlling for other background variables. Thus we have modeled the macroeconomic impact of health. A theoretical framework has been developed to model this impact between health and growth and this is further tested using a two Stage least square regression model which tests the causality between these variables of interest. These models are tested using time series data. We found out that there is a positive relationship between per capita income and life expectancy, and an inverse relationship between carbon dioxide and life expectancy. The reduction in emission gas should be of great concern to Nigeria government because it can determine the level of life expectancy in the country due to its significant impact on life expectancy. We have also assumed in this analysis that these variables are affected by cultural, political and social factors.

Key Words: Health, Economic Growth, multivariate framework.

INTRODUCTION

Economic growth and health status are interdependent and both of them affect poverty. There seems to be a broad consensus that economic growth can definitely lead to improvement in health. For example, economic growth could lead to increased availability of food; increased earnings which makes health spending more affordable and also raises demand for good health services. Higher growth could also imply higher public revenue which can translate to higher investment in health infrastructure.

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Each of the integrals of human capital; education and health, has been proven to have a remarkable impact on economic growth. For instance, education has a strong impact on labour productivity, the rate of innovation, healthy living and technological improvements. Increase in stock of knowledge raises productivity in both market and non-market (household) sectors. This increased productivity is transmitted to increased wages, improved access to health products, which ultimately leads to higher growth and to a general improvement on the aggregate living standard. Duflo (2003) estimates that in Indonesia, any additional school built per 1,000 children leads to an increase in wages of 1.5

to 2.7%.

However, health as a component of the stock of human capital is both a means and an end. It is a means, because its availability generates more earnings while an end, because it is considered as wealth. Also health is both demanded and produced by consumers. Grossman (1972) argued that it is both consumption and an investment good. It is a consumption commodity because it enters into the individual's utility function and an investment commodity because it determines the availability of time for both market and nonmarket activities. Increase in the aggregate stock of health determines total amount of time to be spent earning money.

Health does not only improve growth by making more market time available for the workers to generate income, it also increases healthy practices resulting to a reduction in the mortality rate and also reduces the fertility rate, contributing to voluntary population control. And as Solow (1957) argues, a higher population growth is negatively related with labour productivity. Ranis et al., (2000) found that out of the eight economic growth-lopsided nations in 1960-70, all of them moved through the vicious cycle of low economic growth/low human development. Across countries, economic history has a large record of 'massive divergence in economic growth and development over the several centuries. Across the globe, in the three-four centuries ago, economic indices would show all countries to be relatively poor, if their living standards were assessed in today's economic reality (Durlauf et al., 2004).

Even though, the growth rate of those economies compared in present terms were low, the resulting growth was sustained over time, culminating into increased productivity, output, and a steady rise of the per capita income at the aggregate level. Compared to other nations of Africa and some Asian countries, even though, their economies also grew, it was never consistent or sustained and in most cases, the macroeconomic performance resulted into negative growth.

Improving the health and longevity of the poor is an end to itself, a fundamental goal of economic development. But it is also a means to achieving the other development goals relating to poverty reduction. The linkages of health to poverty reduction and to long term economic growth are powerful, much stronger than is generally understood. The burden of disease in some low-income regions, especially sub-Saharan Africa, stands as a stark barrier to economic growth and therefore must be addressed frontally and centrally in any comprehensive development strategy. According to the old neoclassical growth theories the lower the starting level of per capita gross domestic product (GDP) the higher is the predicted growth rate. The convergence property derives in the neoclassical model from the diminishing returns to capital. Economies that have less capital per worker tend to have higher rates of return and higher growth rate. Thus the production function needs human capital as well as the physical capital which enter as inputs. However, while schooling is often used as an input into human capital, health is not used in production function. The contribution of health to economic growth has been neglected compared to the importance given to education. The objective of this study is therefore to provide and understanding of the effects of health on economic growth in Nigeria.

LITERATURE REVIEW

Improving the health and longevity of the poor is an end to itself, a fundamental goal of economic development. But it is also a means to achieving the other development goals relating to poverty reduction. The linkages of health to poverty reduction and to long term economic growth are powerful, much stronger than is generally understood. The burden of disease in some low-income regions, especially sub-Saharan Africa, stands as a stark barrier to economic growth and therefore must be addressed frontally and centrally in any comprehensive development strategy. The relationship between health and economic growth has received attention in the literature. Adeniyi and Abiodun, (2011) analyzed the effects of health expenditure on the Nigerian economic growth using data on life expectancy at birth, fertility rate, capital and recurrent expenditures between 1985 and 2009 argues that if funds are judiciously expended in the health sector, the effects of this expenditure on the economic growth will be direct and substantial.

Odior, (2011) using an integrated sequential dynamic computable general equilibrium (CGE) model, examined the potential impact of increase in government expenditure on health in Nigeria. His

result shows that the re-allocation of government expenditure to health sector is significant in explaining economic growth in Nigeria, thus the need for government to investment in health services. Odubunmi et al., (2012) examined the relationship between health care expenditure and economic growth in Nigeria for the period 1970-2009. They employed the Multivariate Co-integration Technique proposed by Johansen, (1988) and found the existence of at least one co-integrating vector describing a long run relationship among economic growth, foreign aids, health expenditure, total saving and population. The co-integrating equation however, shows some deviations in terms of the signs of the coefficients of foreign aids and health expenditure which they attributed to some diversification of foreign aids to other uses or inadequate allocation to health services.

Mayer, (2004) in his study on the intergenerational impact of health on economic growth argued that human development is an intergenerational process in which early child development plays a crucial role, and which can be characterized by poverty trap. He claimed that preventing the formation of human capital, would hampered economic growth in the long-term, and reduced the scope of growth policies in other sectors of the economy. He identified factors such as early child nutrition and health as having indirect effects on adult income through education which explained a large portion of the long-term impact of nutrition and health on economic growth. He concluded that, an integral public policy for long-term growth and development aimed at dismantling poverty traps so as to eradicate poverty and inequality must sufficiently emphasize the formation of the coming generations, beginning with early child development. In particular, it must eradicate child malnutrition, including micronutrient deficiency and obesity.

Lucian et al., (2009) further researched into the already established relationship between economic growth and health by using the results of some previous works and applying them on the recent data, in order to find out if the economic growth rate in the current European Union member countries is connected to the growth rates of various diseases. Based on the existing economic theories, they examined if the results found in literatures apply when regressing different types of variables in the EU member states for the period of 1995-2007. Their results show a positive relationship between the health of population and the GDP, with the causality in the relation between the real GDP and the economic growth directed from the economic growth to the diseases growth rates.

Bloom et al., (2004) growth model accounts for economic growth by the growth of factor inputs, technological innovation, and technological diffusion. Their main result, which is consistent with their theoretical argument and with the microeconomic evidence, is that health has a positive and statistically significant effect on economic growth. Their result suggests a one-year improvement in a population’s life expectancy contributes to an increase of 4% in output. This is a relatively large effect, indicating that increased expenditures on improving health might be justified purely on the grounds of their impact on labor productivity, quite apart from the direct effect of improved health on welfare. While this supports the case for investments in health as a form of human capital, they are not able to distinguish in their analysis between the effects of different types of health investments that affect different groups within the population.

Theoretical framework

The theoretical background for this work is neoclassical and it follows the Solow model, which was also adopted by Dauda (2004), and Soludo and Kim (2002). The neoclassical growth theory posits that changes in quantity of factors of production account for economic growth. The theory is built on a technological relationship between output and production inputs such as labour, capital and land. The neoclassical theory has its empirical variant in the Cobb-Douglass production function and can be specified as below:

$$\mathbf{Y = f(A, K, L)} \qquad \mathbf{(1)}$$

Where;

Y = Output,

A = Level of technology/technical progress or total factor productivity,

K = Physical capital stock and

L = Quantity of labour.

In its empirical application, the Cobb-Douglas production function decomposes the sources of growth of total factor productivity (which is derived as a residual).

Solow (1957) discovered that most of the growth in output was accounted for by a linear trend in time, which he named “technical change”, i.e. long-run growth of output per worker depends only on technological progress but short-run growth can result from either technological progress or capital accumulation. Thus the model implies that determining the source of short-run growth is an empirical issue. Growth accounting, which was pioneered by Abramovitz (1956) and Solow (1957), provides a way of tackling the subject. Abramowitz (1956) proposed a more suitable name for this trend; he calls it an “index of our ignorance”. Solow identified the quality of labour, represented by human capital as responsible for the residuals. The influential articles of Romer (1986) and Lucas (1988), advanced an endogenous mechanism for the generation of economic growth, a source of increasing returns associated in Lucas’ view with the accumulation of human capital. An important insight provided by these authors is the possibility for long-run output per unit of input to increase, even when inputs were exhaustively accounted for. By implication, the views of these authors advocates the factoring back of human capital into the aggregate production function which led to the formulation of the augmented Solow model using the Cobb-Douglas production function by incorporating human capital into it. Economic growth (rate of change in output) can thus be represented by the equation below;

$$\frac{\Delta y}{Y} = \frac{\Delta A}{A} + \left(Fk\frac{\Delta k}{y}\right)\left(\frac{k}{k}\right) + \left(FL\frac{\Delta L}{Y}\right)\left(\frac{L}{L}\right) \qquad (2)$$

$$= \frac{\Delta A}{A} + \left(Fk\frac{\Delta k}{K}\right)\left(\frac{k}{Y}\right) + \left(FL\frac{\Delta L}{L}\right)\left(\frac{L}{Y}\right) \qquad (3)$$

Where $\frac{\Delta y}{Y}$ = rate of growth of output
$\frac{\Delta K}{K}$ =Rate of growth of capital
$\frac{\Delta L}{L}$ =Rate of growth of labour force
$\frac{\Delta A}{A}$ = Hicks neutral rate of change in technical progress
F_K, F_L = Social marginal products of capital and labour respectively

Economic growth thus occurs from the accumulation of physical capital and increase in labour force with improved technological embodiment without which labour cannot be effective. The improved technological embodiment is captured in $\frac{\Delta A}{A}$. Human capital is a key determinant of labour productivity because it facilitates the absorption of new technology, increases the rate of innovativeness and promotes efficient management (Adamu, 2003). Consequently, for higher labour productivity, an integral part of technological progress is investment in human capital and this is termed endogenous factor because accumulation of physical capital is enhanced by the knowledge, skills, attitudes health status of the people who partake in such exercise (Lucas, 1988; Romer 1990; Mankiw et al., 1992). Highlighting the importance of human capital in economic growth, the traditional Solow model can be extended to include human capital in the Cobb Douglas function. Thus, following Mankiw et al., (1992) and Bloom et al.,(2001), output is modeled as a function of inputs and technology using the following aggregate production function.

METHOD OF ANALYSIS

In the present study, we model income and health within a simultaneous equation framework. This is because a proper analysis of the relationship between, income and health would, at best, be done within a simultaneous equation framework to allow for the expected bi-directional causation amongst the variables. This is a significant departure from related studies that have adopted single-equation models to examine this relationship. The study utilizes two equations economic growth and health. In the economic growth equation, income per capita is assumed to depend on life expectancy at birth, school enrollment, per capita health expenditure, gross fixed capital formation and working population. In the health equation, life expectancy is assumed to be a function of per capita income, per capita health expenditure, working population and carbon-dioxide.

The study uses annual data from 1995 to 2014 for Nigeria. The data to be used for the analysis are secondary data as published and freely made available by the National Bureau of Statistics and the Central Bank of Nigeria. Complementary source includes the World Bank Data base. Due to the issue of endogeniety and possibility of reverse causation (which theory argues it exists), we propose to use simultaneous equation techniques:

Table 1. summary of descriptive statistics.

	LCO2	LGF	LLE	LPCY	LPHE	LPOP	LPSER
Mean	11.23108	23.04055	3.879802	6.676926	5.121815	18.11005	4.522124
Median	11.45492	22.60987	3.870656	6.584789	5.222726	18.11260	4.535690
Maximum	11.57184	25.17470	3.961600	8.077658	5.773461	18.35492	4.621760
Minimum	10.48685	21.42491	3.825404	5.577068	4.488247	17.86077	4.362556
Std. Dev.	0.398832	1.320276	0.048266	0.891352	0.431701	0.152492	0.074996
Skewness	-1.033297	0.445445	0.334326	0.295964	-0.094863	-0.029410	-0.580196
Kurtosis	2.264130	1.704263	1.618630	1.628249	1.586666	1.825153	2.357911
Jarque-Bera	4.010259	2.060515	1.962733	1.860067	1.694592	1.153105	1.465658
Probability	0.134643	0.356915	0.374799	0.394540	0.428572	0.561832	0.480548
Sum	224.6216	460.8111	77.59604	133.5385	102.4363	362.2009	90.44248
Sum Sq. Dev.	3.022278	33.11946	0.044263	15.09565	3.540957	0.441824	0.106864
Observations	20	20	20	20	20	20	20

The 2SLS is particularly efficient in the presence of endogeneity bias given appropriate instrumentation.

PCY = f (GF, PCHE, LE, PSER, POP) (4)
LE =F (LE, PCY, CO2, POP PCHE.) (5)
The reduced equation after taking the natural logs of both sides is specified below

$LPCY_t = \varphi_0 + \varphi_1 LGF_t\ t + \varphi_2 LPHE_t \varphi_3 LLE_t + \varphi_4 LPSER_t + \varphi_5 LPOP_t + U_{1t)}$ (6)

$LLE_t = ß_0 + ß_1 LPCY_t + ß_2 LPCHE_t + ß_3 LPOP_t + ß_4 LCO2_t + U_{2t}$ (7)

This system of simultaneous equation has 2 endogenous variables, namely, per capita income and life expectancy at birth, while there are 7 exogenous (predetermined) variables the two structural equations are identified, each equation is over identified the equation also satisfied the Rank condition (the necessary and sufficient condition) of identification. See appendix for proof. The 2SLS estimator, being an instrumental variable technique, yields estimated coefficients that are consistent, asymptotically normal and asymptotically efficient Green (2003) and Iyoha (2004).

The variables (that formed the model) are expressed with respect to time, where;
PCY = per capita income
GF = gross fixed capital formation
PCHE = per capital health expenditure
LE = life expectance, at birth
PSER= primary school enrolment
POP = 15-64 years population
CO_2 = carbon dioxide
U= error term
$ß_0$= are intercept
$ß_s$, ,$\varphi_s$are coefficients of the independent variables.

ESTIMATION AND ANALYSIS OF RESULTS

Table 1 provides information about the descriptive statistics for the dependent and explanatory variables in the model. It can be deduced from Table 1 all the series displayed a high level of consistency on the means and median values are within the minimum and maximum values of these series.

Moreover, standard deviation which measures the degree of dispersion of the variables from the mean shows that the variables are relatively stable. This is due to the low values of standard deviation for all the variables as shown in table. Also all the variables were a normal shape as its kurtosis is less than three. Finally, Jacque-Bera statistics shows that the data do support the supposition that each variable has a normal distribution. This is as a result of the accepting of null hypothesis that each

Table 2. Dependent variable: LPCY

Method: Two-Stage Least Squares				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-19.85044	26.10241	-0.760483	0.4596
LLE	0.907729	0.19635	3.063032	0.0118
LPSER	-0.355851	0.878564	-0.405037	0.6916
LGF	0.682083	0.296557	2.300006	0.0373
LPOP	2.602910	2.468144	1.054602	0.3095
LPHE	0.113155	0.164294	0.688736	0.5022
R-squared	0.976516	Mean dependent var		6.676926
Adjusted R-squared	0.968129	S.D. dependent var		0.891352
S.E. of regression	0.159128	Sum squared resid		0.354504
F-statistic	117.5039	Durbin-Watson stat		1.487762

Table 3. Dependent Variable: LLE

Method: Two-Stage Least Squares				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	1.024197	0.736225	1.391146	0.1845
LPCY	0.032159	0.006571	4.894399	0.0002
LPHE	0.005632	0.003519	1.600621	0.1303
LPOP	0.157254	0.044864	3.505084	0.0032
LCO2	-0.020999	0.004367	-4.809028	0.0002
R-squared	0.994310	Mean dependent var		3.879802
Adjusted R-squared	0.992793	S.D. dependent var		0.048266
S.E. of regression	0.004098	Sum squared resid		0.000252
F-statistic	653.1928	Durbin-Watson stat		1.498274

variable has a normal distribution at low probability values.

From Table 2, equation (6) explaining per capital income. The estimated growth model puts the adjusted Coefficient of determination at 0.96, showing that 96% of the variation in per capita income is explained by the included regressors while the remaining 4% is unaccounted for, hence they are explained by the Gaussian white noise. These results are quite good.

The F value is highly significant; the hypothesis of a log linear relationship between six variables cannot be rejected at the one percent level. All the Coefficients have the expected signs expects log primary school enrolment that have negative signs. The results indicate a statistically significant positive relationship between physical capital (proxied by gross fixed capital formation) and the log population age (15-64) years, with marginal contributions of 0.68 and 2.60 respectively. However, the coefficient of Health per capital expenditure, primary school enrolments are not statistically significant.

From Table 3, equation (7) explained the life expectancy which is even better than equation (6)

with the five variables employed the explanatory variables is able to explain bout 99 percent of life expectancy during the period of study. The F-values is highly significant and all the Coefficients have the expected signs. The per capita income, population and carbon dioxide Coefficients are significantly different from zero at the 1 percent level and the health per capita expenditure are significant at the 5 percent level. Since the variables are in logarithms, the Coefficients are elasticities. There is a two way causation between economic growth and the effect of health measured by life expectancy is positive and significant on economic growth. Per capita income can be achieved by increasing and improving stock of health human capita, the indication is that life expectancy is significance in all our specification. This can be so as a percentage increase in life expectancy rate increase the level of growth by 0.9 percent.

The working population emerges as a significant determinant of economic growth in Nigeria, an increase in working force population is positive and statistically significant. The insignificant effect of health per capital expenditure on growth can be attributed to the small share of health as a ratio of total government expenditure.

Health expenditure is just about 4% of total expenditure which therefore accounts for its insignificance in the regression. The health equation results from equation estimation estimates indications that, increase income per capita have a positive and statistically significant at the 1 per cent level effects on life expectancy. 10 percent increase in growth of per capita raised life expectancy by 3.2 percent.

The working population age have a positive and statistically significant on life expectancy. There is also evidence of a significant positive relationship between health per capita expenditure and life expectancy. There is evidence of a significant inverse relationship between gas emission and life expectancy. It implies that a 10 percent increase in the gas emission would reduce the life expectancy years by 2 percent.

CONCLUSION AND POLICY RECOMMENDATION

From results, it can be deduced that there is a positive relationship between per capita income and life expectancy. This means, that the factors influencing life expectancy needs to be given serious attention if sustainable economic growth is to be achieved.

Higher investment in health infrastructure will increase life expectancy as there is a positive relationship between per capita health expenditure. There is an inverse relationship between carbon dioxide and life expectancy. An improvement in health enhances labour productivity and leads to gains in economic growth. Education, environmental factors, strong macroeconomic and efficient institutional policies are equally important for economic growth.

Nigerian government should adopt policies that will increase public expenditure in the health sector. A continuous rise per capita income consistency over a long period could improve life expectancy. The reduction in emission gas should be of great concern to Nigerian government because it can determine the level of life expectancy in the country due to its significant effect on life expectancy. However, improving public health can be an important tool for reducing poverty.

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APPENDIX: Proof of identification of equations of the model.

We now show that 2 equations of our model satisfies with the ORDER condition (the necessary condition) of identification and the RANK condition (the necessary and sufficient condition) of identification.

(i) Order condition for identification for equation i

LPCY equation *k j* = 3 and m j = 2 since 3 > 2, this equation is over identify.

LLE equation k j = 5 and m j = 2 since 5>2 this equation is over identify.

(ii) Rank condition of identification

According to Green C (2003) the rank condition imposes a restriction on a sub matrix of the reduced-from co-efficient matrix in order to ensure that there is exactly one solution for the structural parameters given the reduced form parameters.

The sub-matrix for LPCY equation is [i]
(i) Consider the sub matrix with 1 column and 1 row. Since there is no column or row consisting of only zeros, we conclude that the equation is identified.

The sub matrix for LLE equation is [ii]
(ii) The sub-matrix with 2 columns and 1 row. Since there are no columns and row consisting of only zeros, we conclude that the equation is identified.